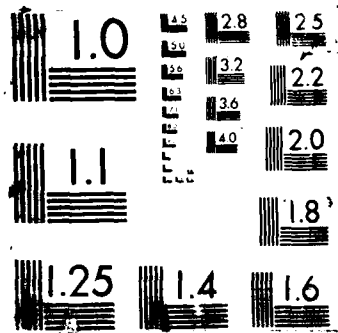


AD-A195 540 NONLINEAR MECHANISMS FOR THE GENERATION OF NEARSHORE 1/1
WAVE PHENOMENA(U) MASSACHUSETTS INST OF TECH CAMBRIDGE
DEPT OF MECHANICAL ENGIN. T R AKYLAS APR 88
UNCLASSIFIED ARO-21692. 2-HA DAAG29-85-K-0171 F/G 8/3 NL





2

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

AD-A195 540

REPRODUCTION PURPOSES

DTIC FILE COPY

REPORT PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified		1b. RESTRICTIVE MARKINGS	
2a. SECURITY CLASSIFICATION AUTHORITY MAY 17 1988		3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited.	
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE		5. MONITORING ORGANIZATION REPORT NUMBER(S) ARO 21692.2-MA	
4. PERFORMING ORGANIZATION REPORT NUMBER		7a. NAME OF MONITORING ORGANIZATION U. S. Army Research Office	
6a. NAME OF PERFORMING ORGANIZATION MIT	6b. OFFICE SYMBOL (if applicable)	7b. ADDRESS (City, State, and ZIP Code) P. O. Box 12211 Research Triangle Park, NC 27709-2211	
6c. ADDRESS (City, State, and ZIP Code) Dept. of Mechanical Engineering Cambridge, MA 02139		9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER DAAG29-85-K-0171	
8a. NAME OF FUNDING/SPONSORING ORGANIZATION U. S. Army Research Office	8b. OFFICE SYMBOL (if applicable)	10. SOURCE OF FUNDING NUMBERS	
8c. ADDRESS (City, State, and ZIP Code) P. O. Box 12211 Research Triangle Park, NC 27709-2211		PROGRAM ELEMENT NO.	PROJECT NO.
		TASK NO.	WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) Nonlinear Mechanisms for the Generation of Nearshore Wave Phenomena			
12. PERSONAL AUTHOR(S) T. R. Akylas			
13a. TYPE OF REPORT Final	13b. TIME COVERED FROM 7/1/85 TO 2/29/88	14. DATE OF REPORT (Year, Month, Day) April 1988	15. PAGE COUNT 3
16. SUPPLEMENTARY NOTATION The view, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.			
17. COSATI CODES		18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)	
FIELD	GROUP	SUB-GROUP	
		Nearshore Wave Phenomena; Shallow Beaches; Water Waves; Beach Slope;	
19. ABSTRACT (Continue on reverse if necessary and identify by block number) Theoretical study of various generation mechanisms of nonlinear edge-wave phenomena on beaches through asymptotic and numerical techniques. In particular, the nonlinear longshore modulational instability of edge-wave packets has been investigated. Also, the forced response of water waves near cut-off conditions in a shallow channel was studied. Finally, numerical techniques for computing fully nonlinear periodic edge-wave phenomena on shallow beaches have been developed.			
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT <input type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS		21. ABSTRACT SECURITY CLASSIFICATION Unclassified	
22a. NAME OF RESPONSIBLE INDIVIDUAL		22b. TELEPHONE (Include Area Code)	22c. OFFICE SYMBOL

The studies have shown that (i) large-scale longshore variations of standing subharmonic edge waves are unstable and eventually give rise to recurrence phenomena. (ii) asymptotic analysis of the forced response of water waves near cut-off conditions leads to a forced Kadomtsev-Petviashvili equation. Numerical solutions of this equation indicate that steady state is reached only if dispersion is negative; otherwise, periodic generation of localized wave groups is found. (iii) there is numerical evidence that there is a critical steepness above which nonlinear periodic edge waves cease to exist; this threshold value of the steepness depends on the beach slope.

FINAL REPORT

1. ARO PROPOSAL NUMBER: 21692-MA
2. PERIOD COVERED BY REPORT: 1 July 1985 - 29 February 1988
3. TITLE OF PROPOSAL:
Nonlinear Mechanisms for the Generation of Nearshore Wave Phenomena
4. CONTRACT NUMBER: DAAG29-85-K-0171
5. NAME OF INSTITUTION: Massachusetts Institute of Technology
6. AUTHOR OF REPORT:
T.K. Akyias
Department of Mechanical Engineering
Massachusetts Institute of Technology
Cambridge, MA 02139

PROBLEM DESCRIPTION

Theoretical study of various generation mechanisms of nonlinear edge-wave phenomena on beaches through asymptotic and numerical techniques. In particular, the nonlinear longshore modulational instability of edge-wave packets has been investigated. Also, the forced response of water waves near cut-off conditions in a shallow channel was studied. Finally, numerical techniques for computing fully nonlinear periodic edge-wave phenomena on shallow beaches have been developed.

SUMMARY OF RESULTS

We have shown that: (i) large-scale longshore variations of standing subharmonic edge waves are unstable and eventually give rise to recurrence phenomena. (ii) asymptotic analysis of the forced response of water waves near cut-off conditions leads to a forced Kadomtsev-Petviashvili equation. Numerical solutions of this equation indicate that steady state is reached only if dispersion is negative; otherwise, periodic generation of localized wave groups is found. (iii) there is numerical evidence that there is a critical steepness above which nonlinear periodic edge waves cease to exist; this threshold value of the steepness depends on the beach slope.

LIST OF PUBLICATIONS AND PRESENTATIONS

1. T.R. Akylas & S. Knopping, "The Evolution of Subharmonic Edge Wavepackets on a Sloping Beach", *Wave Motion* 8, 399-405 (1986) [also presented at the Fourth Army Conference on Applied Mathematics & Computing, Cornell University, May 1986].
2. Y.D. Kantzios & T.R. Akylas, "Long Nonlinear Water Waves in a Channel Near Cut-off Conditions", *Studies in Applied Mathematics* 78, 57-72 (1988).
3. T.R. Akylas & Y.D. Kantzios, "Nonlinear Forced Water Waves in a Shallow Channel Near a Cut-off Frequency" in: *Nonlinear Water Waves* (eds. K. Horikawa & H. Maruo), pp. 63-67 (1987).
4. T.R. Akylas & J. Mathew, "Nonlinear Edge Waves on a Shallow Beach", presented at the 40th Meeting of the American Physical Society (Fluid Dynamics Division), Eugene, Oregon, November 1987.
5. T.R. Akylas, "Nonlinear Forced Waves" in: *Nonlinear Wave Interactions in Fluids* (eds. R.W. Miksad, T.R. Akylas & T. Herbert), pp. 157-163 (1987).

<input checked="checked" type="checkbox"/>	Codes
<input type="checkbox"/>	Avail and/or
<input type="checkbox"/>	Special
A-1	

LIST OF PARTICIPATING PERSONNEL

T.R. Akylas, associate professor (principal investigator)

S. Knopping, graduate research assistant (received S.M. January 1986)

Thesis: "Nonlinear Edge Wave Interactions on Beaches"

Y.D. Kantzios, graduate research assistant (received S.M. June 1987)

Thesis: "Nonlinear Forced Standing Waves in a Shallow Channel Near Cut-off Conditions"

J. Mathew, graduate research assistant, Ph.D. candidate

END

DATE

FILMED

9-88

DTIC